

MOLECULAR WIRE TRANSISTOR (MWT)

ABSTRACT OF THE DISCLOSURE

5 Bipolar and field effect molecular wire transistors are provided. The molecular
wire transistor comprises a pair of crossed wires, with at least one of the wires comprising a doped semiconductor material. The pair of crossed wires forms a junction where one wire crosses another, one wire being provided with Lewis acid functional groups and the other wire being provided with Lewis base functional groups. If both
10 wires are doped semiconductor, such as silicon, one is P-doped and the other is N-doped. One wire of a given doping comprises the emitter and collector portions and the other wire comprises the base portion, which is formed by modulation doping on the wire containing the emitter and collector at the junction where the wires cross and between the emitter and collector portions, thereby forming a bipolar transistor. Both
15 NPN and PNP bipolar transistors may be formed. Analogously, one wire may comprise doped semiconductor, such as silicon, and the other wire a metal, the doped silicon wire forming the source and drain and the metal wire forming the gate by modulation doping on the doped silicon wire where the wires cross, between the source and drain, to form a field effect transistor. Both P-channel and N-channel FETs may be formed. The
20 construction of both bipolar transistors and FETs on a nanometer scale, which are self-aligned and modulation-doped, is thereby enabled.